EXPERIMENTAL RESEARCHES

ON THE

GRANITES OF IRELAND.

BY

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Experimental Researches *on the* Granites *of* Ireland.

By the Rev. Samuel Haughton, M.A., F.G.S., Fellow of Trinity College, and Professor of Geology in the University of Dublin.

Part II. (*Continued*).—On the Granites of the North-east of Ireland*.

I. Potash-Granites of the North-east District.
II. Soda-Granites of the North-east District.

In the concluding part of my paper on the Granites of the North-east of Ireland†, I have expressed the opinion that the granites of the neighbourhood of Newry are divisible, like those of Leinster, into two types, viz. potash- and soda-granites; and that, if a line north of east be drawn through Newry, the granites south of this line are potash-granites, including the Mourne granites, while the granites to the north of this line are soda-granites. As I have obtained additional confirmation of this opinion since the reading of my paper, it will be useful here to sum up the facts known relative to the two kinds of granite in the two districts under consideration.

I. Potash-Granites of the North-east District.

I shall exclude from this discussion the granites of the Mourne district north of Carlingford Bay, as they form a peculiar group, characterized by the presence of distinct crystals of albite, and nests of crystallized quartz.

The following Tables contain the analyses and atomic quotients of five granites of the potash-type, south and south-east of Newry:—

No. 1. Granite from the base of Slieve na glogh, medium-grained, composed of quartz, white felspar, and green mica.

No. 2. Granite from Grange Irish, near Carlingford, fine-grained, composed of quartz, white felspar, and hornblende.

No. 3. Granite from Wellington Inn, south of Newry, medium-grained, composed of quartz, white felspar, and green mica.

No. 4. Granite from Fathom Lock, east of Newry, porphyritic, of a general pink colour, with white nests and minute cavities lined with very small crystals of quartz.

The paste consists of a reddish felspar, with minute specks and streaks of dark-green chloritic hornblende, and small hexagonal crystals of quartz. The felspar-crystals are semi-transparent, of good lustre; size $\frac{1}{2}$ in. by $\frac{1}{8}$ in. The white roundish nests are probably white felspar, with flattish faces and scarcely any lustre. Epidote and green earth appear in the small cavities in connexion with the minute hexagonal crystals of quartz.

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* For Part I. and Part II. see Quart. Journ. Geol. Soc. vol. xii. p. 171 & p. 188.
† *Loc. cit.* p. 198.

No. 5. Granite from Jonesborough Mountain, south of Newry, presenting a general resemblance to that last described, with the exception that it contains no white nests or small cavities.

The paste is the same as the last (No. 4). The crystals of pinkish felspar are more distinct and numerous than in the last rock. No quartz is visible, except in connexion with some occasional and partially formed cavities. Blackish-green stains and patches accompany the quartz, as in No. 4.

TABLE I.—*Analyses of Potash-Granites.*

	1.	2.	3.	4.	5.
Silica	70·48	71·41	71·24	72·08	71·00
Alumina	14·24	12·64	14·36	14·36	13·60
Peroxide of iron ...	3·72	4·76	3·36	3·02	3·28
Lime	1·48	1·80	1·48	1·17	1·06
Magnesia.....	0·40	0·63	0·64	0·36	0·51
Potash	4·26	5·47	4·09	5·58	5·73
Soda	3·66	3·03	3·13	2·91	3·27
Protoxide of iron ..	.....	.....	.....	1·59	1·30
Loss by ignition ...	1·59	.....	1·50	.....	.....
Totals	99·83	99·74	99·80	100·98	99·75

The following Table shows the atomic quotients found from the preceding analyses in the usual manner:—

TABLE II.—*Atomic Quotients of Potash-Granites.*

	1.	2.	3.	4.	5.
Silica	1·566	1·586	1·583	1·600	1·577
Alumina.....	0·274	0·243	0·276	0·276	0·261
Peroxide of iron...	0·046	0·059	0·042	0·038	0·041
Lime	0·053	0·064	0·053	0·042	0·038
Magnesia	0·020	0·031	0·032	0·018	0·025
Potash	0·090	0·116	0·087	0·119	0·122
Soda	0·118	0·098	0·101	0·094	0·105
Protoxide of iron .	.....	.....	.....	0·041	0·036

Adding together the protoxides and peroxides in the preceding Table, we obtain the following:—

TABLE III.—*Atomic Quotients of Silica, Peroxides, and Protoxides in Potash-Granites.*

	1.	2.	3.	4.	5.	Average.
Silica	1·566	1·586	1·583	1·600	1·577	1·582
Peroxides ...	0·320	0·302	0·318	0·314	0·302	0·311
Protoxides...	0·281	0·309	0·273	0·314	0·326	0·301

The preceding results show that these granites have a general family resemblance, and that they should be grouped together. The

quantity of green mica, hornblende, or chlorite is small; and, if it be neglected, we find, from the column of average atomic quotients, the following number of atoms of quartz and felspar in the potash-granites of the Newry district:—

$$Q = 0{\cdot}358$$
$$F = 0{\cdot}306.$$

From these numbers, we find the per-centages of quartz and felspar,

Quartz = 16·11 per cent.
Felspar = 83·91 ,,

100·02

If we take into consideration the mica or hornblende present in the granite, and consider it to be the same as the green mica of the Mourne range, described in page 191 of my former paper, we shall have the following equations to determine the number of atoms of quartz, felspar, and mica:—

$$Q+4F+5M=1{\cdot}582$$
$$F+3M=0{\cdot}311$$
$$F+2M=0{\cdot}301.$$

From these equations, we readily obtain

$$Q=0{\cdot}408$$
$$F=0{\cdot}281$$
$$M=0{\cdot}010.$$

Assuming the atomic weights of quartz and the green mica as 45 and 500 respectively (see p. 201. vol. xii.), we obtain finally the following:—

Mineralogical Composition of Potash-Granites.

Quartz..... = 18·36
Felspar .... = 76·66
Green mica.. = 5·00

100·02

II. Soda-Granites of the North-east District.

The soda-granites of the North-east of Ireland occur, as I have already observed, to the north of Newry, and are characterized for the most part by pinkish or reddish translucent felspar and black mica,—circumstances indicating the presence of iron.

The following Table contains the analyses of four of those granites.

No. 1. Granite from Newry Quarry, medium-grained, composed of quartz, white felspar passing into pale pink, translucent, and black mica.

No. 2 Elvan-granite from Newry Quarry, intersecting the former in dikes and veins, fine-grained, pink. Besides the elvan-dikes, dikes of dark green-stone also penetrate the granite (No. 1) in Newry Quarry.

No. 3. Granite from Goragh Wood station, north of Newry, medium-grained, composed of quartz, white felspar and black mica.

No. 4. Granite, of gneissose structure, from the cutting south of Goragh Wood Station, medium-grained, composed of quartz, red felspar, and green mica, arranged in a flaky gneissose manner.

TABLE IV.—*Analyses of Soda-Granites.*

	1.	2.	3.	4.
Silica	64·60	74·20	62·08	66·56
Alumina.....	14·64	10·84	15·92	13·52
Peroxide of iron...	6·04	1·88	7·72	6·76
Lime	3·16	2·84	5·52	1·20
Magnesia	2·80	Trace	2·16	1·32
Potash	3·15	3·12	2·19	2·73
Soda	4·02	4·77	3·34	3·75
Protoxide of iron .	.....	.....	.....	0·18
Loss by ignition...	1·13	0·83	0·89	2·19
Totals.....	99·54	98·48	99·82	98·21

The elvan-dike (No. 2) differs from the other three granites in the large per-centage of quartz, which is a general characteristic of elvans and felstones, but agrees with them in the relative proportions of the two alkalies.

Reserving the elvan-granite for a separate discussion, I shall now tabulate the atomic quotients of the other granites, which appear to belong to the same family of rocks.

TABLE V.—*Atomic Quotients of Soda-Granites.*

	1.	3.	4.
Silica	1·435	1·375	1·479
Alumina.....	0·281	0·306	0·260
Peroxide of iron...	0·075	0·096	0·084
Lime	0·011	0·019	0·004
Magnesia	0·140	0·108	0·066
Potash	0·067	0·046	0·058
Soda	0·130	0·108	0·121
Protoxide of iron .	.....	.....	0·005

Adding together the silica, peroxides, and protoxides from the preceding Table, I find—

TABLE VI.—*Atomic Quotients of Silica, Peroxides, and Protoxides in Soda-Granites.*

	1.	3.	4.	Average.
Silica	1·435	1·375	1·479	1·429
Peroxides ...	0·356	0·402	0·344	0·367
Protoxides...	0·348	0·281	0·254	0·294

It is evident from a comparison of Tables I., II., III., with Tables

IV., V., VI., that the soda-granites are not so persistent in their character and composition as the potash-granites of the same district. This result is in accordance with that which I formerly deduced from an examination of the potash- and soda-granites of Leinster, and admits, as I think, of an explanation which I shall presently give.

Assuming that the mica present, as green or black mica, in these granites is the green mica of Mourne, I find the following equations by the method described in Vol. xii. p. 201:

$$Q+4F+5M=1{\cdot}429$$
$$F+3M=0{\cdot}367$$
$$F+2M=0{\cdot}294.$$

From these equations, I find

$$Q=0{\cdot}472$$
$$F=0{\cdot}148$$
$$M=0{\cdot}073.$$

And, using the atomic weights of quartz and green mica already given, I obtain finally—

The Mineralogical Composition of the Soda-Granites of the North-east of Ireland.

Quartz....	21·24
Felspar ..	41·45
Mica	36·50
	99·19

It may here be observed, that the quantity of free silica or quartz in the soda-granites is comparable with that of the potash-granites; but it is much more visible to the eye than in the latter, although from the analyses it appears that the soda-granites are deficient in silica, as compared with the potash-granites, containing, in fact, 7 or 8 *per cent.* less; this is due to the usually large quantity of mica present in the soda-granites, as this mineral requires much less silica than felspar. This example shows how necessary it is to check the impressions of the eye by the severer test of laboratory analysis. A geologist, speculating on the origin of these granites, and not having the resources of chemistry at his command, might pronounce them to be richer in silica than the potash-granites, whereas it appears that, like other soda-granites, they are really more basic, and may have been formed from potash-granites by the addition of iron, magnesia, lime, and soda.

From the analysis of the pink elvan-dikes penetrating the granite of Newry Quarry, it appears that the atomic quotients of silica, peroxides, and protoxides, are as follow:—

Atomic Quotients of Silica, Peroxides, and Protoxides in the Soda-Elvan.

Silica.....	1·649
Peroxides ..	0·231
Protoxides ..	0·321

From the fact that the atoms of protoxides exceed the atoms of peroxides, it appears that this elvan cannot be composed of quartz, felspar, and green mica.

If we suppose that hornblende replaces mica in this elvan, and that half the iron is present as protoxide, and that all the alkalies belong to the felspar of the rock, it is easy to calculate the following

Mineralogical Composition of the Soda-Elvan.

Quartz....	=29·52
Felspar ..	=60·15
Hornblende	= 8·81
	98·48

From the discussion of the granites of the potash- and soda-type in this district, I feel disposed to draw the following conclusions, which are confirmed in a remarkable manner by some observations I have recently made, in conjunction with Mr. Jukes, in the County Wicklow:—

1st. That both in Leinster and the county Down, the potash-granites are more constant in composition, both mineralogical and chemical, than the corresponding soda-granites.

2ndly. That the potash-granite appears to be the standard type of granite, from which other granites and crystalline rocks are formed by the addition of bases; for example, the anorthite syenite of Carlingford, and the soda-granites of Newry, and in Leinster the outlying patches of granite between the main chain and the sea.

3rdly. That the potash-granite of Leinster is more persistent in external character than the potash-granites of Newry, although the latter are equally constant in chemical composition.